Viburnum Trend
Lead Haul Roads
Reynolds, Dent, and Iron Counties, MO

Presented by

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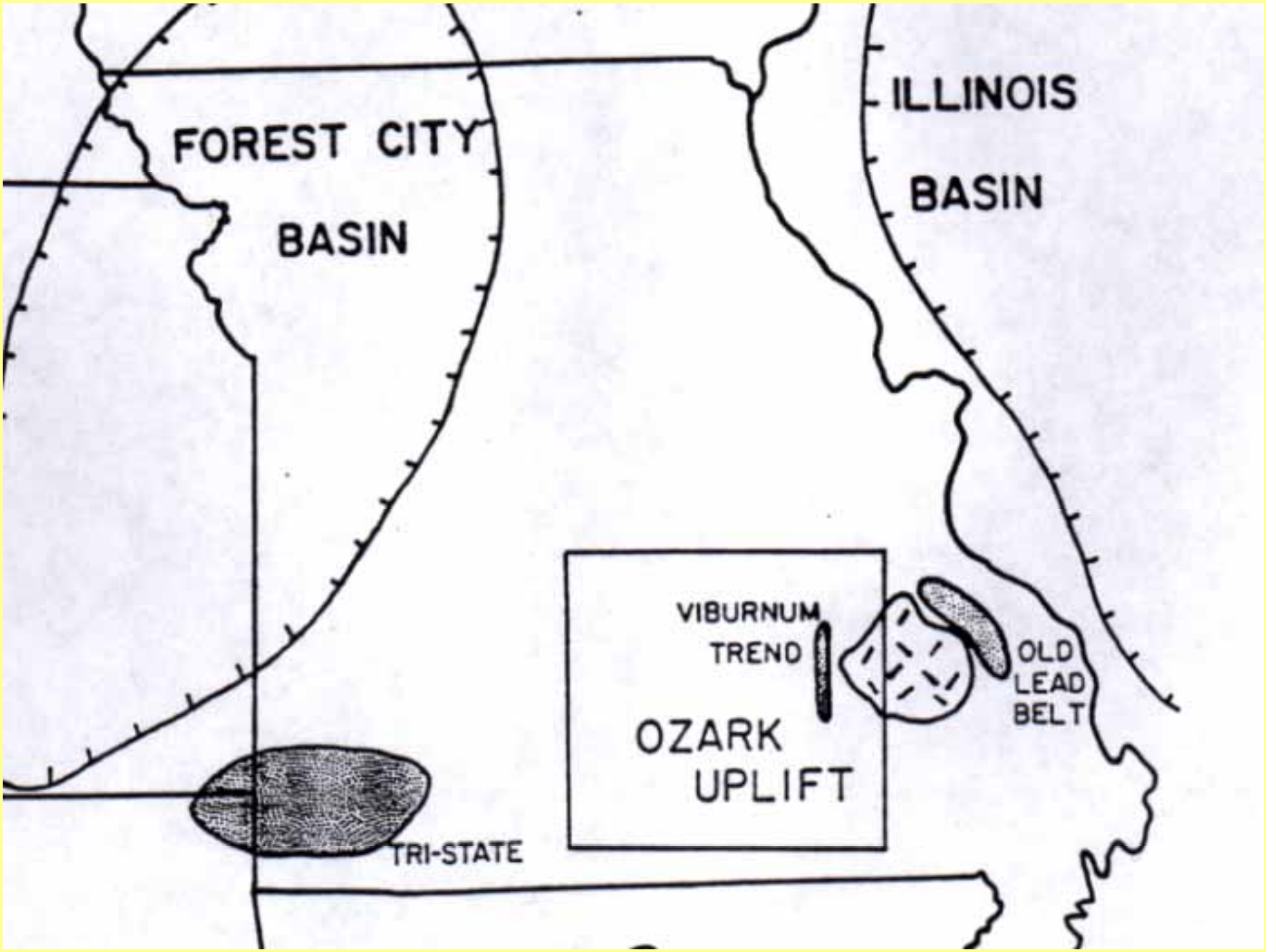
Missouri Department of Natural Resources


FOREST CITY
BASIN
ILLINOIS
BASIN
VIBURNUM
TREND
OLD
LEAD
BELT
OZARK
UPLIFT
TRI-STATE

Purpose

- Determine whether wind blown deposition of lead ore concentrate from haul trucks has caused significant contamination in the surface soil

- Determine if there is a threat to human health and the environment along the haul routes

Background

- Missouri Department of Transportation (MoDOT) Investigation in early 1990's
  - Concern over asphalt manufactured using mining wastes
  - Control highways (non-mining waste asphalt) designated
  - Samples collected at 0, 5, 10, and 15 feet from edge of road in highway right-of-way

MoDOT Conclusions

- MoDOT results
  - >10, 000 ppm lead detected along control roads in southeastern MO
  - Suspected wind blown lead ore concentrate deposited during transportation from mine, mill, and smelter locations
  - Also suspected spill incidents along haul routes

HWP Spill List

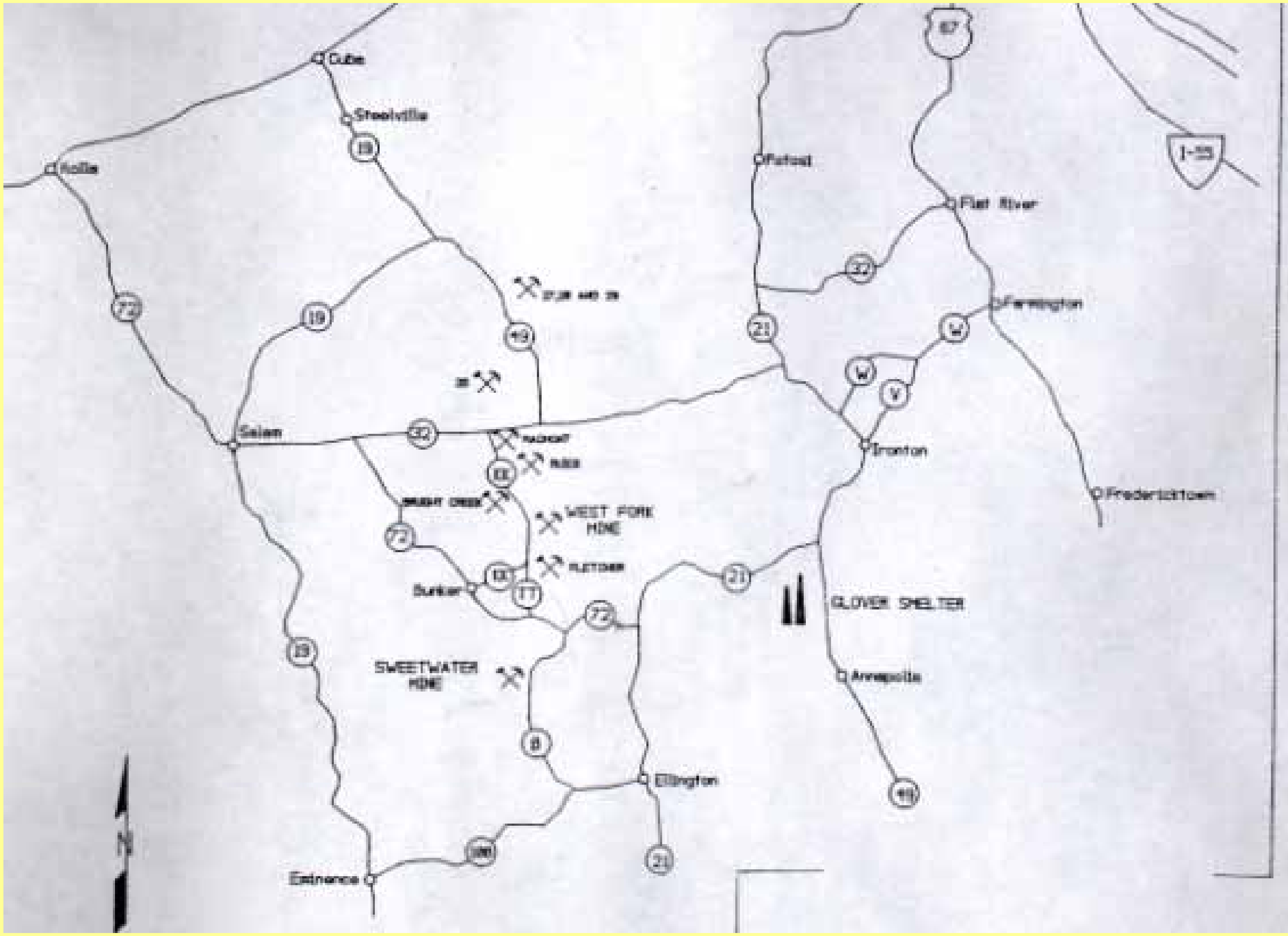
- MDNR's Hazardous Waste Program (HWP) began to construct list of known spill incidents from mining trucks in southeastern MO
- Intent to investigate spill incidents to determine widespread or localized contamination

Spill Investigation

- 'State Route 49 Lead Spill-7/94' -1998
  - Location of truck spill that had been remediated
  - Pre-CERCLIS SS detected lead at 21,000 and 127,000 ppm just below surface; 2,278 to 9,410 ppm in the surface; and TCLP lead values of 80.9 and 857 ppm
  - Site entered into the state Cooperative Program

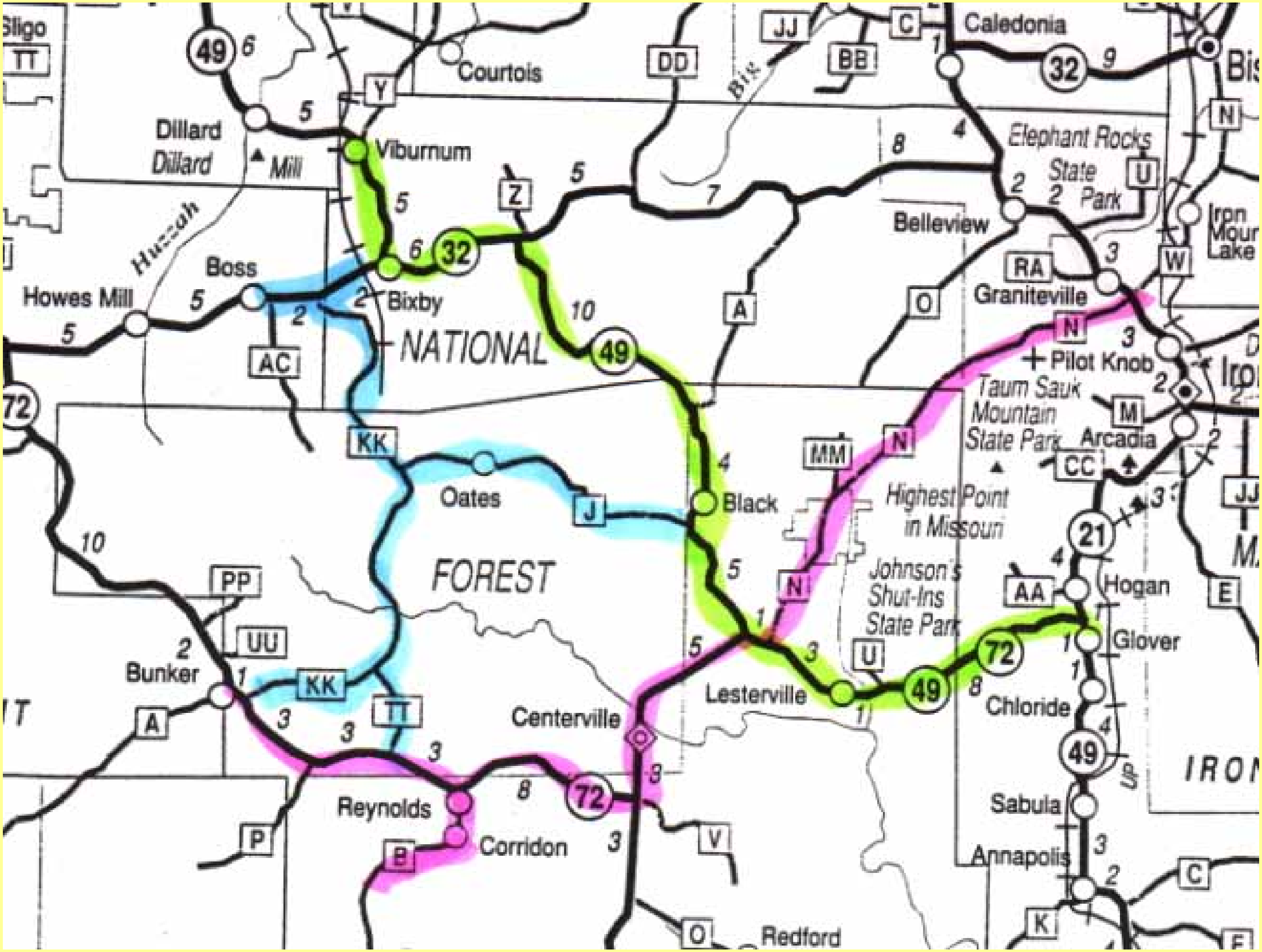
Herculaneum, MO

- Herculaneum Lead Smelter-2001
  - oldest smelter in Missouri, receives lead ore concentrate from the Southeast Mining District
  - >20,000 ppm detected along haul routes through town
  - Decision made to investigate haul routes of the Viburnum Trend of the Southeast Mining District


Cuba
Steelville
Rolla
Potosi
Flat River
Farmington
I-55
67
19
72
49
32
21
W
V
Salem
Ironton
Fredericktown
WEST FORK
MINE
Bunker
EE
TT
SWEETWATER
MINE
GLOVER SMELTER
Annapolis
Ellington
Eminence
106
N

Project Design

- Nine roadways within the Viburnum Trend
- Roadways divided into 18 segments; each between 5-10 miles in length
- Three investigation routes created (each containing six segments)
- HWP team assigned to each route



Sligo
Courtois
Caledonia
Dillard
Dillard
Mill
Viburnum
Elephant Rocks State Park
Belleview
Iron Mountain Lake
Huzzah
Boss
Bixby
Howes Mill
NATIONAL
Graniteville
Pilot Knob
Taum Sauk Mountain State Park
Arcadia
Oates
Black
Highest Point in Missouri
FOREST
Johnson's Shut-Ins State Park
Hogan
Glover
Bunker
Lesterville
Chloride
Centerville
Reynolds
Corridon
Sabula
Annapolis
Redford
IRON

Windshield Surveys

- Windshield surveys conducted along routes
  - Potential targets identified: residences, sensitive environments, drainage areas, and waterways
  - Spill sites from inventory list identified along each route
  - One route was divided into two separate investigations due to the number of targets

Sampling Plan

- Sample types: target, non-target, and background
- Each segment along the route: 2 background surface soil, 1 non-target surface soil
- Target samples included both surface soil and sediment

Sampling Plan (cont.)

- Sample Locations
  - Background Soil: >50 feet from edge of road, outside influence of wind blown deposition
  - Target and Non-target Soil: Increments of 0, 5, 10, 15, 20 feet from edge of road
  - Target Sediment: expected drainage point of entry from road


DOE RUN
RESOURCE
RECYCLING
DIVISION
ISO 9002 CERTIFIED
SUPPORT OFFICE


12. 5. 2001

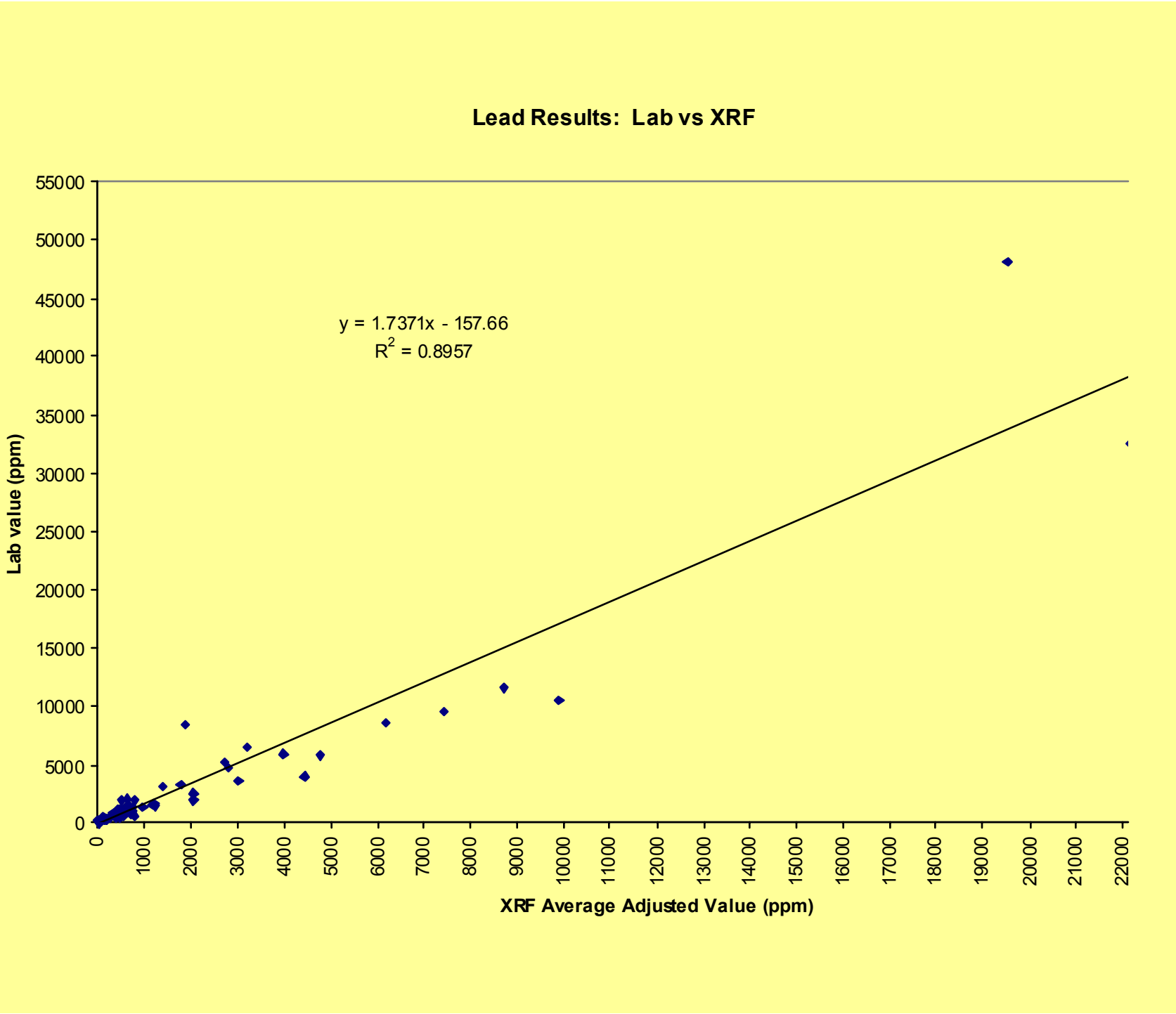
Data Analysis--XRF

- X-Ray Fluorescence (XRF) Screening
  - Spectrace 9000 XRF detector
  - Valid results: total lead >10 times standard deviation (SD)
  - Non-detect: total lead <3 times SD
  - Invalid results: >3 or <10 times SD, screening repeated with higher runtime for Cadmium 109 source, sample not considered if still invalid

Sample ID Code	*Lead Level (ppm)*	*Lead Standard Deviation*	*XRF Value Adjusted (detection limit)*	*XRF Value Adjusted (application)*	*XRF Average Adjusted Value (ppm)*	*Relation between Lead Level and Lead Standard Deviation*
T1-32B-01-S125	25.1	8.45	25.35	27.9	117.3	3.0
T1-32B-01-S125	188	18	188	206.8		10.4
T1-32B-02-S0	-12.2	3.37	10.11	11.1	11.1	-3.6
T1-32B-02-S05	-17.6	1.7	5.1	5.6	30.9	-10.4
T1-32B-02-S05	51	10.3	51	56.1		5.0
T1-32B-02-S10	25.6	7.76	23.28	25.6	25.6	3.3
T1-32B-02-S15	268	19.2	268	294.8	294.8	14.0
T1-32B-02-S20	-10.7	3.43	10.29	11.3	89.3	-3.1
T1-32B-02-S20	152	14.4	152	167.2		10.6

Data Analysis--Lab

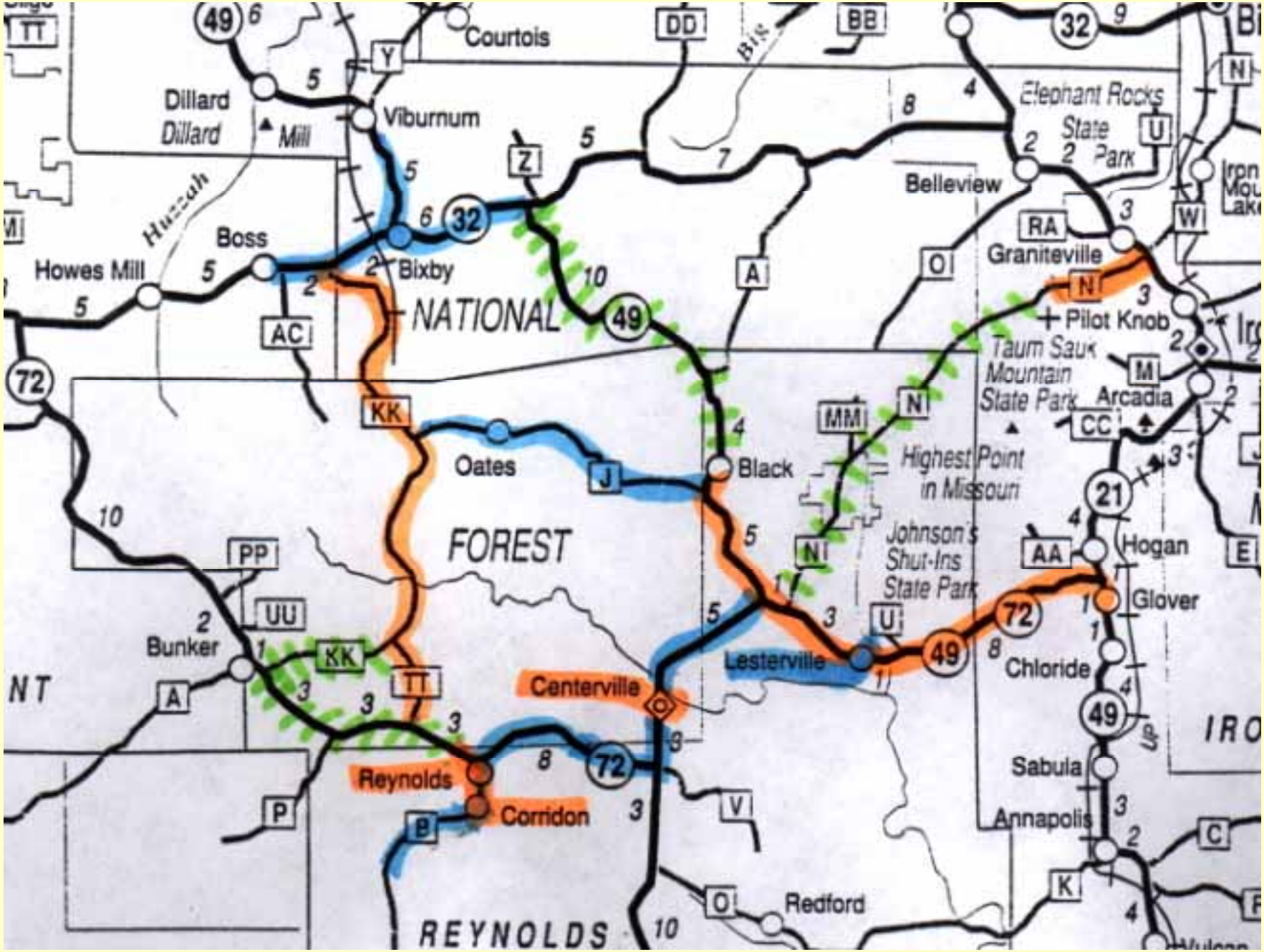
- Laboratory Confirmation
  - 10% confirmation planned, increased to 20% due to occasional XRF detector error messages
  - More than 400 samples were collected among the four investigation routes; 81 submitted
  - Analyzed for lead, cadmium, and zinc
  - Linear Regression analysis with lab results


Lead Results: Lab vs XRF
y = 1.7371x - 157.66
R2 = 0.8957
Lab value (ppm)
XRF Average Adjusted Value (ppm)
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
13000
14000
15000
16000
17000
18000
19000
20000
21000
22000

Project Decision- Design

- XRF data correlated with sampling points
- Segments compared as one continuous route
- ‘Hot spots’ identified
- Route re-segmented based on areas of concern: 16 new segments

Viburnum Trend Lead Haul Roads: Segments for Pre-CERCLIS SS reports						
	SS Segment Location	SS Recommendation	Approx. Length	Lowest Lead (ppm)	Highest Lead (ppm)	Team
1	Centerville	RA	Town	11	3198	T4
2	Hwy 21 between West Fork and Middle Fork of Black River	RA	3	206	2795	T2
3	Hwy 21 S of Centerville to Hwy 72, then 21/72 to Reynolds	RA	11	39	6177	T2
4	Hwy 32 from Boss to Hwy 49 & Hwy 49 to Viburnum	RA	15	4	2296	T1
5	Hwy 49 from Glover to Lesterville	RA	11	175	8737	T1
6	Hwy 49 from Lesterville to Route J (at Black)	RA	5	10	7422	T1
7	Hwy 49 from Route J to Hwy 32	NFAP	14	8	2713	T1
8	Hwy 72 from KK to Reynolds	NFAP	9	11	2580	T4
9	Hwy N 3 miles south of Hwy 21 to Hwy 49	NFAP	3	19	729	T2
10	Lesterville	RA	Town	11	10296	T1
11	Route B from Reynolds/ Corridon	RA	Towns	179	2047	T4
12	Route J from KK to Hwy 49 (Oates)	RA	12	32	4730	T3
13	Route KK from Hwy 32 to Route TT then to Hwy 21/72	RA	18	36	23243	T3
14	Route KK from Route TT to Hwy 72	NFAP	4	36	171	T3
15	Route N from Hwy 21, approx. 3 miles southwest	RA	3	18	671	T2
16	Rural Route B (from Corridon to Sweet Water Mine)	RA	4	36	4772	T4


Courtois
Dillard
Dillard
Mill
Viburnum
Huzzah
Boss
Howes Mill
Bixby
NATIONAL
FOREST
Oates
Black
Belleview
Elephant Rocks
State
Park
Graniteville
Pilot Knob
Taum Sauk
Mountain
State Park
Arcadia
Highest Point
in Missouri
Johnson's
Shut-Ins
State Park
Hogan
Glover
Chloride
Lesterville
Centerville
Bunker
Reynolds
Corridon
Redford
Sabula
Annapolis
REYNOLDS
IRO
NT

Project Decisions

- Viburnum Trend Lead Haul Roads
  - Areas of concern: 16 segments defined
  - Pre-CERCLIS SS for areas of concern
    - 12 recommended for Removal Assessment
    - 4 recommended for No Further Action

Future Investigations

- Issues remaining for the Viburnum Trend Lead Haul Roads Site
  - Removal Assessments of known segments
  - City of Viburnum, where mill is located
  - Routes continuing through the Old Lead Belt and into the east-central portion of Missouri